

CHAPTER 82. EVALUATE/INSPECT PART 121 EXTENDED-RANGE OPERATIONS WITH TWO-ENGINE AIRCRAFT

SECTION 1. BACKGROUND

1. PROGRAM TRACKING AND REPORTING SUBSYSTEM (PTRS) ACTIVITY CODES.

A. *Maintenance*: 3319

B. *Avionics*: 5319

3. OBJECTIVE. This chapter provides guidance for an inspector to perform an evaluation and surveillance of Title 14 of the Code of Federal Regulations (14 CFR) part 121 operator requesting a deviation for extended-range operations with two-engine airplanes, as per Advisory Circular (AC) 120-42, Extended Range Operations with Two-Engine Airplanes (ETOPS).

5. GENERAL.

A. *Definition.* Extended-Range Operation With Two-Engine Airplanes (ETOPS) are operations conducted over a route containing a point further than one hour flying time at the normal one-engine inoperative cruise speed (in still air) from an adequate airport.

B. An ETOPS authorization requires a deviation to the operating rule of 14 CFR part 121, § 121.161. To meet the requirements of this deviation, the operator must be able to:

(1) Substantiate that the type design reliability and performance of the proposed airplane/engine combination have been evaluated in accordance with AC 120-42 and found suitable for extended range operations.

(2) Submit a package that includes the following programs:

(a) *Verification program.* This program is designed to verify corrective actions. It must have procedures that would preclude an airplane from being dispatched for extended range operation after propulsion system shutdown, primary system failure or significant adverse trends on a previous flight, unless appropriate corrective action has been taken.

(b) *Verification flights.* ETOPS operators should have verification flight procedures described in their supplemental maintenance program for events involving propulsion system shutdown, engine or major engine module change, primary system failure, and for certain adverse trends or prescribed events. In the case of engine change or a major engine module change, the requirement of a verification flight is in addition to the normal test cell and ground run procedures. It is permissible to designate the period of

time from airport departure to entry into the ETOPS environment as maintenance verification flight, in combination with a regularly scheduled ETOPS revenue flight, provided the verification phase is documented as satisfactorily completed upon reaching the ETOPS entry point. It is important to note when this type of ETOPS verification flight is conducted:

- There are written procedures to ensure the flightcrew is fully briefed prior to dispatch concerning the event and/or the maintenance performed.
- Appropriate maintenance personnel should convey to the flightcrew the specific observations and/or actions required of them during the verification portion of the flight as well as the method to be used to properly record the satisfactory completion of that verification flight.
- All flightcrew observations and/or actions must be completed upon entering the ETOPS portion of the flight.

(c) *Engine condition monitoring.* This program should provide a system for data collection and analysis that ensures timely analysis and correction of engine problems. This program should be designed to prevent in-flight shutdowns of powerplant systems.

(d) *Reliability program.* This is in addition to the regular reliability program and should be designed primarily to identify and prevent problems. The program should incorporate reporting criteria for use by the carrier and the Federal Aviation Administration (FAA) as a measure of extended range reliability.

(e) *Auxiliary power unit (APU).* The following criteria shall be included in the operator's APU in-flight start validation program, as part of their overall ETOPS maintenance program for each specific airframe/engine combination. APU in-flight starts should be made on flights of four hours or more, subject to the following conditions:

- In-flight APU starts need not be performed on ETOPS flights (the APU must be in the ETOPS configuration in accordance with the applicable configuration and maintenance procedures (CMP) document, in order for credit to be allowed.

- If in-flight APU starts are performed on an ETOPS flight, the start should be attempted on the return leg to the United States.
- The start attempt should be initiated before top of descent, or at such time that will ensure a two-hour cold soak at altitude.
- If the APU fails to start on the first attempt, subsequent start attempts may be made within the limits of the airframe and APU manufacturer design specifications.
- A continuation of the initial in-flight start validation program may be required, if less than 95 percent of in-flight start reliability is achieved in coordination with the Principle Maintenance Inspector (PMI).

(f) *Initial validation period.* All occurrences of an ETOPS configured APU in-flight unsuccessful start attempt (which exceed the airframe and APU manufacturer design specifications), shall be reported to certificate-holding district office (CHDO). All APU in-flight start failures, occurring during actual ETOPS operations, should be reported within 72 hours in accordance with AC 120-42A, appendix 4. The report should include corrective actions taken as well as the status of corrective action programs, fleet upgrades, etc.

(g) *APU data collection for ETOPS:*

- A specific airframe/engine combination must demonstrate substantial service experience during within essential airframe and propulsion systems achieve an acceptable level of reliability.
- ETOPS consideration also include requirements that the high level of reliability of essential airframe and propulsion equipment will be ensured by the operator's maintenance program.
- The provisions of AC 120-42A, stipulates that an APU in-flight start/run reliability be substantiated in order to ensure adequate reliability for ETOPS. ETOPS operators shall use an initial APU in-flight start/run program to substantiate their ability to maintain inherent APU in-flight start reliability levels for each airframe and engine combination.

(h) *Engine/APU oil consumption monitoring program.* This program must monitor oil consumption on a flight by flight basis, with verification of the oil system integrity made prior to each extended range leg.

(i) *Extended range parts control.* This program should ensure that the precise parts required by type design criteria are utilized to maintain the integrity of the systems that are unique to extended range operations. This program must consider verification of parts placed on aircraft through parts borrowing and pooling agreements.

(j) *Maintenance training program.* The training program should focus on extended range awareness for all personnel involved in the extended range program. It may be included in the normal maintenance training but should emphasize the special nature of two-engine extended range maintenance requirements.

(k) *Continuing analysis and surveillance program.* The air carrier's normal continuing analysis and surveillance program should be supplemented to require regular surveillance of the extended range program. The program's analysis should be used by the carrier as a means to ensure the integrity and adjust their ETOPS programs.

C. *Points of Contact.* For questions regarding an ETOPS authorization, contact:

- AFS-210, Air Carrier Training Branch
- AFS-330, Airworthiness - Air Carrier Maintenance Branch
- Aircraft Evaluation Group (AEG)
- Aircraft/Engine Certification Directorate

D. *Surveillance.* Due to the critical nature of the extended range maintenance program and its relationship to safety, special emphasis should be placed on surveillance of the approved extended range maintenance program. Surveillance consists of the following:

- Trend analysis
- Problem identification and resolution
- Implementation of corrective action

(1) The inspector must ensure that approved extended range maintenance programs are followed as outlined in the maintenance manual sections referenced in the operations specifications.

(2) The operator must submit proposed changes to the approved extended range maintenance program to the CHDO for review 60 days before implementation. Supporting documentation must accompany the proposal. Upon review, the inspector may allow proposed changes that enhance the program. The inspector must not allow approved program elements to be deleted or degraded.

(3) This surveillance must emphasize events and include trends.

(a) The inspector must report events or problems to the Aircraft Evaluation Group, ANM-270 or ANE-250, within 72 hours. The following are examples of events to be reported:

- In-flight shut downs
- Diversions or turnbacks
- Uncommanded power changes or surges
- Inability to control the engine or obtain desired power
- Problems in systems critical to the safety of extended range operations
- Any other event the inspector considers detrimental to extended range operations

(b) These reports must contain the following information:

- Type of aircraft
- N-number of the aircraft
- Engine type and serial number
- Total time and cycles, including last inspection or shop visit
- Total time since overhaul or inspection of the unit or system affected
- Phase of flight. Include climb, cruise, and descent. Coordinate with operations inspectors to acquire information such as speed, altitude, ambient temperatures, and atmospheric conditions during the event.
- Location and length of diversion or turn-back
- Corrective actions taken

- Any other information pertinent to the event

(c) Each month, the inspector must acquire and provide to the Aircraft Evaluation Group the following information:

- Summary of in-flight shut down rates
- Delays and cancellations
- Ground events (aborted takeoff, power shortfall or loss, and engine removals)

(d) Special events may require the gathering and dissemination of the following information to the requesting FAA authorities:

- Engine condition monitoring and oil condition monitoring program summaries
- Component removal failure summaries
- Pilot reports
- Any other information, as requested

(4) *Trends.* Surveillance should also be directed toward identification and correction of adverse trends. Examples of adverse trends include the following:

- Repeat pilot write-ups
- Degradation of engine condition
- High fluid consumption rates
- Reoccurrence of deficient areas as identified by the carrier's continuing analysis and surveillance program
- Abuse of the minimum equipment list (MEL)

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SECTION 2. PROCEDURES

1. PREREQUISITES AND COORDINATION REQUIREMENTS.

A. Prerequisites:

- Knowledge of the regulatory requirements of part 121
- Successful completion of the Air Carrier Maintenance and Electronic Indoctrination Course

B. Coordination. This task requires coordination between maintenance and avionics inspectors, region, AFS-200, and AFS-300.

3. REFERENCES, FORMS, AND JOB AIDS.

A. References:

- AC 120-42, Extended Range Operations with Two-Engine Airplanes (ETOPS)
- Operator's manuals
- FAA Order 8300.10, Airworthiness Inspector's Handbook

B. Forms:

- FAA Form 8400-8, Operations Specifications

C. Job Aids:

- Automated operations specifications checklists and worksheets

5. PROCEDURES.

A. Verify Compliance of Aircraft With Type Data Document. Accomplish through coordination with the Aircraft Evaluation Group.

B. Review the Operator's Manual. The inspector must ensure that the following programs have been included in the operator's manual:

(1) Verification program, to include:

- List of primary systems, by Air Transportation Association chapter
- Conditions that require verification flights
- Procedures for initiating verification actions
- Procedures that monitor and evaluate corrective actions
- Procedures that identify and reverse the adverse trends
- Procedures that verify the implementation of corrective action

(2) Engine condition monitoring program, to include:

- Scope of program, e.g., data collection and analysis
- Notification procedures for deterioration
- Deterioration monitoring limits for internal engine parts

(3) Reliability program, to include:

- Reporting criteria
- Procedures to ensure reporting of significant individual events (engine shutdowns, flight diversions, etc.)

(4) Engine/APU oil consumption monitoring program, to include:

- Established limits of consumption
- Procedures for use and verification prior to the start of each extended range leg

(5) Extended range parts control, to include:

- Methods of verification of proper parts
- Control procedures during parts pooling and borrowing

(6) Maintenance training program, to ensure:

- Personnel are aware that an ETOPS authorization is in place
- Personnel, including contract personnel, are adequately trained on the special programs required by an ETOPS authorization

(7) Continuing analysis and surveillance program, to include:

- Frequency of audits
- Reports generated by audits
- Ease of use

(8) At the successful completion of the operator's APU program validation, each operator is to establish a monitoring program acceptable to the local FAA CHDO to ensure that the APU will continue at a level of performance and reliability established by the manufacturer or FAA. Operators with existing approved programs may continue on their current program. This monitoring program should include periodic sampling of APU in-flight starting. This sampling interval may be adjusted according to system performance. PMI's shall periodically review APU in-flight-

start program to ensure system reliability and recommend adjustments where necessary.

C. Analyze Results.

(1) If problems are found, return material to operator.

(2) If submitted material is found to be acceptable, forward the material to AFS-300 for concurrence of approval.

7. TASK OUTCOMES.

A. File PTRS Data Sheet.

B. Successful completion of this task will result in the following:

- An Extended-Range Operation With Two-Engine Airplanes Authorization
- Operations specifications paragraphs D086 and D086-1

9. FUTURE ACTIVITIES. Normal surveillance.